



PRETERM BIRTH AS A RISK FACTOR FOR HEARING LOSS IN NEONATES

Otorhinolaryngology

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ABSTRACT

Background: Hearing loss is among the most common congenital disorders, with the potential to severely affect speech, language, and cognitive development in children. Premature birth is a well-recognized but sometimes overlooked contributor to hearing impairment in neonates. **Objectives:** This study aimed to assess hearing status in neonates, using Transient Evoked Otoacoustic Emission (TEOAE) and Brainstem Evoked Response Audiometry (BERA), and to determine the role of prematurity as a significant risk factor for neonatal hearing loss. **Methods:** A prospective observational study was carried out in the Department of Otorhinolaryngology at a tertiary care medical college and hospital from January 2024 to December 2024. A total of 100 neonates admitted to the Neonatal Intensive Care Unit (NICU) underwent hearing screening using TEOAE at 48 hours, 1 month, and 3 months of life. Those with persistent REFER outcomes were further evaluated with BERA. The relationship between prematurity and other potential risk factors with hearing loss confirmed on BERA was analyzed. **Results:** A significant association was observed between prematurity (69%) and hearing loss ($p < 0.001$). Other factors that showed a significant link to hearing loss included low APGAR scores, perinatal asphyxia, prolonged NICU admission, and neonatal sepsis. **Conclusion:** Premature birth is a key risk factor for hearing impairment in neonates, underscoring the importance of focused screening in this vulnerable group.

KEYWORDS

Hearing Loss; Preterm Birth; Neonates; Newborn hearing Screening; Risk Factors

INTRODUCTION

Hearing loss is one of the most common congenital disorders and can significantly impair speech, language, cognitive, and social development in children if not detected early. The estimated global prevalence of congenital hearing loss is approximately 2 to 3 per 1,000 live births, making it a major public health concern [1]. Among the various risk factors for hearing loss in neonates, preterm birth has emerged as one of the most significant yet often under-recognized contributors [2].

Preterm birth, defined as delivery before 37 completed weeks of gestation, is associated with multiple complications, one of which is the increased risk of hearing impairment. Studies have shown that the prevalence of moderate to severe bilateral hearing loss is considerably higher in preterm infants compared to term neonates, especially among those requiring care in Neonatal Intensive Care Unit (NICU) [3,4]. This increased susceptibility is attributed to the immature development of the auditory system in preterm neonates, compounded by factors such as low birth weight, prolonged NICU stay, exposure to ototoxic medications, mechanical ventilation, perinatal infections, and hyperbilirubinemia [2,4].

Preterm infants constitute a large proportion of NICU admissions, placing them at particular risk. Even mild or unilateral hearing loss, if undetected, can result in delayed language acquisition, poor academic performance, and social difficulties in later life [5].

Early identification of hearing loss through Universal Newborn Hearing Screening (UNHS), using Otoacoustic Emissions (OAE) and Brainstem Evoked Response Audiometry (BERA), is vital to ensure timely intervention and rehabilitation [5,6]. In India, hearing screening is increasingly being implemented in tertiary care centres, but there remains a lack of focused research on the relationship between prematurity and hearing loss in neonates, despite the high burden of preterm births in the country [7].

The study assessed hearing status in neonates, with a focus on identifying preterm birth as a key risk factor for hearing loss. Early detection in this high-risk group is crucial for timely intervention and preventing long-term developmental delays.

MATERIALS AND METHODS

This was a prospective observational study conducted from January 2024 to December 2024 in Department of Otorhinolaryngology, of a tertiary care medical college and associated hospital. A total of 100 neonates up to one year of age were enrolled after obtaining informed written consent from parents or guardians. Neonates whose parents did not provide consent were excluded.

After ethical clearance, hearing screening was performed in NICU-admitted neonates to assess hearing status and identify association of preterm birth and other risk factors to hearing loss. Automated Transient Evoked Otoacoustic Emissions (TEOAE) was conducted using the NEUROSOFT handheld device, which provided PASS or REFER results. The first TEOAE screening was done at 48 hours of life after cleaning the external auditory canal, with delayed screening at 3 to 5 days for neonates whose clinical condition improved later. Neonates with REFER results underwent a second TEOAE screening at one month and, if still REFER, a third TEOAE screening done at three months of age.

Persistent REFER cases on third TEOAE screening were evaluated with Brainstem Evoked Response Audiometry (BERA) using the NEUROSOFT device. Electrodes were applied to the forehead and mastoid regions, and alternating click stimuli were delivered. Both ears were tested simultaneously.

In neonates diagnosed with hearing loss on BERA, correlation with prematurity and other risk factors was assessed. Other risk factors included low birth weight, Apgar score at 1 minute < 4 , perinatal asphyxia, prolonged NICU stay, syndrome associated with hearing

loss, neonatal convulsion, neonatal sepsis.

Data were collected using a structured proforma and analyzed with Microsoft Excel. Pearson's correlation coefficient and Chi-square test were used to assess associations, with p-values <0.05 considered significant.

RESULTS

Our study evaluated the importance of early neonatal hearing evaluation in a tertiary care setting. Study group consists of total 100 NICU admitted neonates. 61% were males and 39% were females (Table 1). 61% neonates were delivered by lower segment caesarean section (LSCS) and 39% neonates were normal vaginal delivery (NVD). 69% were preterm and 31% were term neonates (Table 2).

Table 1: Distribution Of Study Participants According To Age And Gender

		N	%
Age	2 days	66	66.00
	3 days	10	10.00
	4 days	17	17.00
	5 days	7	7.00
Gender	Male	61	61.00
	Female	39	39.00

Table 2: Distribution Of Study Subjects As Per Obstetric And Gestational Profile

		n	%
Mode of delivery	NVD	39	39.00
	LSCS	61	61.00
Gestational Age	Preterm	69	69.00
	Term	31	31.00
Gestational age (in weeks)	< 28 weeks	3	3.00
	28 – 31 weeks	16	16.00
	32 – 36 weeks	50	50.00
	≥ 37 weeks	31	31.00

Distribution of study subjects to clinical parameters and risk factors seen (Table 3,4).

Table 3: Distribution Of Study Subjects As Per Clinical Parameters

		N	%
Low Birth Weight	<1.5 kg	41	41.00
	≥1.5 kg	59	59.00
APGAR at 1 min.	< 4	28	28.00
	≥4	72	72.00
Perinatal Asphyxia	Yes	23	23.00
	No	77	77.00
NICU Admission	>5 Days	39	39.00
	≤5 Days	61	61.00

Table 4: Distribution Of Study Subjects As Per Risk Factors Associated With Congenital Hearing Loss

		N	%
Syndrome Associated With Congenital Hearing Loss	Down Syndrome	1	1.00
	No	99	99.00
Neonatal Convulsion	Yes	3	3.00
	No	97	97.00
Neonatal Sepsis	Yes	21	21.00
	No	79	79.00

On first TEOAE screening, out of 100, 82 neonates were REFER and 18 were PASS. 82 neonates were again screened at 1 month of age, out of which, 25 were REFER and 57 were PASS. These 25 neonates underwent rescreening at 3 months of age, out of which 10 were REFER and 15 were PASS. These 10 neonates underwent BERA for confirmation of hearing loss.

BERA showed hearing loss in these 10 neonates, out of which 80% preterm neonates had moderately-severe to severe hearing loss, and 20% term neonates had moderately-severe hearing loss. Preterm birth, low APGAR score, perinatal asphyxia, neonatal sepsis and prolonged NICU stay were significantly associated with hearing loss on BERA (p-value < 0.05). Low birth weight, syndrome associated with congenital hearing loss and neonatal convulsions were not significantly associated with hearing loss on BERA (Table 5).

Table 5: Association Of Perinatal Factors With BERA Testing Outcomes”

		BERA					
		Yes		No		Chi Sq.	p-Value
		N %	N %				
Mode of delivery	NVD	2	20.00	37	41.11	0.92	0.339
	LSCS	8	80.00	53	58.89		
Gestational Age	< 28 weeks	0	0.00	3	3.33	1.01	<0.001
	28 – 31 weeks	2	20.00	14	15.56		
	32 – 36 weeks	6	60.00	49	54.44		
	≥ 37 weeks	2	20.00	30	33.33		
Low Birth Weight	<1.5 kg	6	30.00	35	38.89	0.90	0.343
	≥1.5kg	4	60.00	55	32.22		
APGAR at 1 min.	< 4	9	90.00	19	21.11	17.91	<0.001
	≥4	1	10.00	71	78.89		
Perinatal Asphyxia	Yes	9	90.00	14	15.56	24.12	<0.001
	No	1	10.00	76	84.44		
Neonatal sepsis	Yes	5	50.00	16	17.78	3.86	0.032
	No	5	50.00	74	82.22		
NICU Admission	>5 Days	9	90.00	30	33.33	9.88	0.002
	≤5 Days	1	10.00	60	66.67		
Syndrome associated with congenital hearing loss	Down syndrome	1	10.00	0	0.00	1.80	0.180
	No	9	90.00	90	100.00		
Neonatal convulsion	Yes	1	10.00	2	2.22	0.15	0.274
	No	9	90.00	88	97.78		

DISCUSSION

In our study, the majority of neonates (66%) underwent hearing screening on the second day of life, consistent with global recommendations for early newborn hearing screening, as in Rawat et al. (2023) and Nayak et al. (2022) [8,9]. A significant association was observed between screening after the third day and abnormal BERA results (p < 0.001), suggesting that slightly delayed screening may improve specificity by reducing transient false-positive results.

Gender distribution showed a male predominance (61%), but no significant association with hearing loss (p = 0.506), in line with studies by Swain et al. (2017) and Roat et al. (2024) [10,11]. Although caesarean section (61%) was common, mode of delivery was not statistically associated with hearing loss (p = 0.339), similar to findings by Kumar et al. (2024) [12]. However, caesarean deliveries often reflect high-risk pregnancies, indirectly linked to adverse outcomes.

Prematurity was a key finding, with 69% of neonates born before 37 weeks, primarily between 32–36 weeks. Prematurity was significantly associated with hearing loss (p < 0.001), corroborating findings by Gouri et al. (2015) and Omar et al. (2022) [13,14]. Immature auditory pathways and increased NICU exposure contribute to this risk.

Low birth weight (<1.5 kg) was observed in 41% but showed no significant association with hearing loss (p = 0.186), consistent with Hajare et al. (2022) [15]. In contrast, low APGAR score at 1 minute < 4 and perinatal asphyxia were strongly linked to hearing impairment (p < 0.001), highlighting the role of hypoxic injury, as also reported by Shukla et al. (2021) and M Aziza et al. (2022) [16,17].

Prolonged NICU stay significantly increased hearing loss risk (p = 0.002), as did neonatal sepsis (p = 0.032), consistent with findings by Siddique et al. (2022) [18].

TEOAE screening revealed a decline in REFER rates over time, reinforcing the importance of repeated assessments. BERA confirmed hearing loss in 10 neonates, out of which 80% (8 out of 10) were preterm neonates. These findings underscore the critical need for early, repeated hearing screening, especially among preterm neonates, to facilitate timely intervention and improve long-term outcomes.

CONCLUSION

In conclusion, preterm birth is a significant risk factor for hearing loss in neonates. Early, repeated screening using TEOAE and BERA is essential for timely detection, particularly in preterm and high-risk neonates, to ensure early intervention and better developmental outcomes.

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Ethical Approval: Obtained.

Consent: Written consent secured.

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